REMARKS / DISCUSSION OF ISSUES

The present amendment is submitted in response to the Office Action mailed May 6, 2009. Claims 1-3 and 5-13 remain in this application. In view of the remarks to follow, reconsideration and allowance of this application are respectfully requested.

The Invention

It is instructive to first briefly review the invention. Generally, the invention enables compensation for the threshold voltage variations in poly-silicon drive transistors (for example a low temperature poly-silicon TFTs). More particularly, one problem overcome by the invention relates to a problem associated with voltage-programmed pixels, particularly using poly-silicon thin film transistors. The problem is that different transistor characteristics across the substrate (particularly the threshold voltage) give rise to different relationships between the gate voltage and the source-drain current, and artifacts in the displayed image result. The invention provides a novel solution for compensating for these threshold voltage variations.

In one aspect, the invention provides a pixel circuit which enables threshold voltage information to be provided to external measuring circuitry with a simple drive scheme. In the display pixel circuit of the invention, one additional (shorting) transistor is connected between the gate and drain of the drive transistor in order to provide a threshold voltage measurement function, externally of the pixel array. As in a conventional pixel arrangement, a pixel is voltage-addressed, and a storage capacitor holds the voltage on the gate of the drive transistor after a pixel addressing phase. The additional shorting transistor is connected between the gate and drain of the drive transistor. The shorting transistor is controlled by an additional control line. The invention also requires that a common cathode terminal of the drive transistor be switchable between two voltages. The shorting transistor is used to discharge the voltage on the gate of the drive transistor until it switches off. This discharge operation involves the removal of charge from the storage capacitor until the voltage across the capacitor reaches the threshold voltage. The resulting voltage on the data line, through the address transistor which is turned on, is measured by allowing the data line to float by placing the data line in a high impedance state so that the voltage on the data line substantially follows the gate voltage of the drive transistor. Once the threshold voltage has been determined, the

pixel data voltages to be applied to the pixels are modified. This can be carried out in the column driver circuits, and can be carried out in the digital or analogue domain.

Interview Summary

Applicants appreciate the courtesy granted to Applicant's attorney, Michael A. Scaturro (Reg. No. 51,356), during a telephonic interview conducted on Tuesday, June 23, 2009. During the telephonic interview, Claim 1 was discussed the floating mode in claim 4. Applicant's Attorney agree to amend claim 1 to include the limitations of claim 4 and to define the limitation of floating mode.

Claim Rejections under 35 USC 103

The Office has rejected claims 1-2, 4-6 and 9-13 under 35 U.S.C. §103(a), as being unpatentable over U.S. Patent Application 2005/0156829 ("Choi") in view of U.S. Patent No. 6,618,830 ("Kane"). Applicant respectfully traverses the rejections.

I. Claims 1-2, 5-6 and 9 are Allowable

In response, claim 4 is herewith cancelled, without prejudice or disclaimer and claim 1 has been amended to incorporate the subject matter of now cancelled claim 4 and further incorporate a description of the term "floating mode". It is respectfully submitted that independent claim 1, as herewith amended, and the remaining claims depending therefrom, are clearly patentably distinguishable over the cited and applied references for the reasons detailed below.

The cited portions of Choi and Kane, individually or in combination, fail to disclose or suggest the specific combination of claim 1, as more precisely and specifically claimed. For example, the cited portions of Choi fail to disclose or suggest, *"wherein the data input line (6) is switchable between a voltage driving mode in which it provides voltages to the pixels connected to the line and a floating mode in which the data line is placed in a high impedance state thereby allowing the data line to float to the voltage of the gate of the drive transistor of an addressed pixel",* as recited in claim 1. In contrast to claim 1, the cited portions of Choi disclose a pixel circuit capable of compensating characteristic deviations of driving thin film

transistors. Choi describes the operation of a pixel circuit in accordance with a three step process with reference to Figs. 3 and 4 of Choi. At a first initialization step S1, when the switching transistor M1 turns on by the selection signal SEL1 in a high level, the voltage at the node P1 is set to have an initial voltage level V_{DATA_IN1} of the data voltage. During a following compensation step, S2, if the compensation transistor M2 turns on by the compensation signal SEL2 in a high state during the turn-on of the switching transistor M1, the gate and the drain of the (shorting) transistor M3 are connected to each other (to be in a diode connection) to perform a function of a diode. Between the supply voltage VDD and a ground, two diodes M3 and OELD are connected in series and the voltage at the node P2 becomes to have a characteristic voltage Vc determined by the characteristic of the drive transistor M3. Accordingly, the capacitor C1 stores a voltage difference between the node P1 and the node P2, which equals to a voltage difference $V_{DATA\_IN1}- V_c$ between the initial data voltage V_{DATA_IN1} and the characteristic voltage Vc.

In a subsequent data voltage application step S3, the transistor M2 is cut off by setting the compensation signal SEL2 to have a low value and the data voltage is applied to drive the transistor M3. At this time, since the characteristic voltage Vc is charged in the capacitor C1 in the compensation step, the switching time of the transistor M3 decreases. If the transistor M3 is driven, electric current corresponding to the data voltage flows into the organic EL device through the transistor M3 such that the organic EL device emits light. *See* Choi, par. 49. The Office cites par. 49 of Choi for allegedly teaching a floating mode in which it can float to the voltage of the gate of the drive transistor of an addressed pixel. Applicant respectfully submits that this feature is neither taught nor suggested in Choi. It is respectfully submitted that storing a characteristic voltage Vc in capacitor C1 to decrease the switching time of transistor M3 is different from a capacitor storing a threshold voltage, and transferring the stored threshold voltage to a column capacitance of a data line that is placed in a high impedance state thereby allowing the data line to float to the voltage of the gate of the drive transistor of an addressed pixel to allow the data line voltage to be measured. And once the threshold voltage has been determined via said measurement, the pixel data voltages to be applied to the pixels are modified.

Kane is not cited by the Office for disclosing or suggesting, *"wherein the data input*

line (6) is switchable between a voltage driving mode in which it provides voltages to the pixels connected to the line and a floating mode in which the data line is placed in a high impedance state thereby allowing the data line to float to the voltage of the gate of the drive transistor of an addressed pixel", However, Kane is cited by the Office for allegedly teaching "*wherein the display device further comprises means (42) for measuring a voltage on the data line",* as recited in claim 1. Applicant respectfully disagrees. It is respectfully submitted that the cited portions of Kane, fail to disclose or suggest, *"wherein the display device further comprises means (42) for measuring a voltage on the data line"*, as recited in claim 1 for at least the following reasons.

The Office cites Kane for allegedly describing a display device comprising a measurement module 1330 for measuring the drive transistor's threshold voltage on a line 1210. The Office directs Applicant to Kane, Fig. 13, col. 4, lines 66-67. Applicant respectfully submits that the cited portions of Kane **do not describe a measurement module** for measuring a drive transistor's threshold voltage. Instead, the cited portions of Kane describe a measurement module 1330 comprised of external **current sensing circuits 1334** which are activated via a MEASURE signal to collect information about each pixel's parameters during a special measurement cycle in order to compensate for variations in the TFT and OLED parameters. *See* Kane, col. 15, lines 5-20. The collected information is used to **calculate or adjust the appropriate data voltages** for establishing the desired OLED currents during normal display operation. It is respectfully submitted that collecting current information about each pixel's parameters to calculate or adjust appropriate data voltages is different from *means (42) for measuring a voltage on the data line*, as recited in claim 1.

Thus, the cited portions of Choi and Kane, individually or in combination, do not disclose or suggest, *"wherein the data input line (6) is switchable between a voltage driving mode in which it provides voltages to the pixels connected to the line and a floating mode in which the data line is placed in a high impedance state thereby allowing the data line to float to the voltage of the gate of the drive transistor of an addressed pixel",* or *"wherein the display device further comprises means (42) for measuring a voltage on the data line",* as recited in claim 1. Hence claim 1 is allowable.

Claims 2, 5-6 and 9 depend from independent Claim 1 and therefore contains the limitations of Claim 1 and is believed to be in condition for allowance for at least the same reasons given for Claim 1 above. Accordingly, withdrawal of the rejection under 35 U.S.C. §103(a) and allowance of Claims 2, 5-6 and 9 is respectfully requested.

II. Claims 10-13 are Allowable

Independent Claim 10, as herewith amended, recites similar subject matter as Claim 1 and therefore contain the limitations of Claim 1. Hence, for at least the same reasons given for Claim 1, Claim 10 is are believed to contain patentable subject matter.

Claims 11-13 depend from independent Claim 10 and therefore contains the limitations of Claim 10 and is believed to be in condition for allowance for at least the same reasons given for Claim 10 above. Accordingly, withdrawal of the rejection under 35 U.S.C. §103(a) and allowance of Claims 11-13 is respectfully requested.

Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that all claims presently pending in the application, namely, Claims 1-3 and 5-13 are believed to be in condition for allowance and patentably distinguishable over the art of record.

If the Examiner should have any questions concerning this communication or feels that an interview would be helpful, the Examiner is requested to call Mike Belk, Esq., Intellectual Property Counsel, Philips Electronics North America, at 914-945-6000.

Respectfully submitted,

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